REMARKS

With the entry of this Amendment, claims 29-54 and 57-58 are pending in the application. Claims 55-56 have been cancelled without prejudice.

The claims have been amended in line with the helpful comments of the Examiner and to place them in more conventional U.S. patent claim format and as supported by the specification, e.g., the Summary, the original claims, and the drawings. New claim 57 relates to an emitter as claimed in claim 29 whose micro-structure consists of a plurality of pillar-like micro-projections (as shown in Figures 4-5 and 11 and disclosed in paragraph 66 of the published Application), and new claim 58 relates to an emitter as claimed in claim 29, wherein a blind cavity is defined in at least one of the electrodes ("blind" is supported by Figure 11 and description thereof), for receiving part of the material of the emitter body as a result of volume expansions thereof. The prior art does not disclose these claimed inventions. No new matter has been added.

Claim 42 stands objected. In line with the helpful comments of the Examiner, applicant has amended claim 42, which renders the rejection moot.

Claims 39 and 41 stand rejected under Section 112, second paragraph. Although applicant does not agree with the rejection, the claims have been amended, which render the rejection moot.

Claims 29-41, 43-46, 48-50 and 53-54 stand rejected under 35 USC 103(a) as allegedly being unpatentable over Levinson, in view of McMaster and in further view of Richard. Applicant traverses this rejection for at least the following reasons.

Applicant respectfully submits that the rejection is based on hindsight reasoning and factually incorrect technical arguments.

Regarding independent claim 29, the Examiner states that Levinson discloses an emitter

for incandescence light source capable of being brought to incandescence by means of passage of electric current, wherein on at least one of the surface of the emitter a microstructure is provided, operative to enhance absorbance for wavelength belonging to the visible region of the spectrum. This is incorrect. Levinson never mentions an increase in the absorbance of the emitter thereof, for wavelengths belonging to the visible region of the spectrum. Instead, Levinson relates to a method for producing lamp filaments of enhanced radiative efficiency, i.e., the ratio of power emitted at visible wavelengths to the total radiated power over all wavelengths.

The Examiner also states that Levinson does not teach that the emitter is characterized such that the microstructure is at least partly made of a material whose melting temperature is lower than the operating temperature of the emitter. Yet, the Examiner alleges that, "*in the same field of endeavour,*" McMaster would teach an "*emitter*" that is at least partly made of a material in order to achieve "*low resistance for the operation of the emitter.*" Applicant strongly disagrees for at least the following reasons and facts.

First, respectfully stated, the Examiner is <u>wrong</u> when he states that McMaster would disclose an "*emitter.*" McMaster does not disclose an emitter. Instead, McMaster describes a <u>phototube</u>, i.e., a device which <u>does not emit</u> any light. A phototube <u>receives</u> light, i.e., it is excited by light to generate a current. A phototube is in fact a light-sensitive device operating according to the photoelectric effect, i.e., incoming photons strike a photocathode, generating electrons which are attracted toward an anode. Thus, a current flow is generated, which depends on the frequency and intensity of the incoming light. Summarizing, a <u>phototube is the ***opposite*** of a light emitter and one skilled in the art of incandescence light emitters would have no motivations to seek inspiration in the filed of phototubes.</u>

Second, the Examiner alleges that it would have been obvious to one of ordinary skill in

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the art to modify the emitter surface, as disclosed by McMaster, in the device of Levinson in order to "*achieve low resistance for the operation of the emitter.*" This is not logical and not "reasonably apparent" – as required by the Supreme Court in *KSR*. Respectfully stated, the way the Examiner is contorting and applying McMaster to Levinson is pure hindsight and is technically incorrect.

Significantly, claim 29 relates to an incandescence emitter. Incandescence is emission of visible electromagnetic radiation from a body due to its temperature. Incandescence occurs in light sources because the filament material resists the flow of electrons, i.e., the filament is heated to incandescence due to the electric resistance of the used material. Contrary to the Examiner's assumption, the skilled person would never try to reduce electric resistance in an incandescence emitter.

Third, the claimed invention is based on a completely different approach compared to the Examiner's incorrect allegation. In the invention, low-melting point materials are used, such as gold, silver and copper, because the inventors discovered that these materials have emitting properties (i.e., optical constants) that are more advantageous than tungsten. This has nothing to do with electric conduction.

As explained in the application, the inventors discovered that, in order to obtain from these materials the most advantageous emission, the emitter has to be brought to the highest temperature possible, and this entails the possibility that the material melts. For this reason, according to the claimed invention, the emitter is coated with the refractory oxide, which is configured to preserve the surface nanostructure.

Continuing with the rejection of claim 29, the Examiner states that the combination of Levinson and McMaster does not teach that at least a substantial portion of the emitter is coated

with an oxide having a high melting point, to preserve a profile of the microstructure in case of deformation or change of state of the material thereof. However, according to the Examiner, "*in the same field of endeavour*," the third reference, i.e., Richard, would disclose an incandescence lamp filament which is coated with an oxide with high melting point in order to suppress blackening of the lamp envelope. According to the Examiner, it would have been obvious to one of ordinary skill in the art to modify the filament resulting from the combination of Levinson and McMaster based on Richard, to avoid blackening of the lamp envelope. Applicant strongly disagrees with these alleged facts and reasoning.

According to Richard (see first part of the description thereof) blackening occurs in lamps wherein the filament is made of refractory metal (namely tungsten) or carbon. In the filament according to the invention, the outer surface of the emitter body consists of a microstructure made of a material different from a refractory <u>metal</u> or carbon, which fact avoids *per se* the risk of blackening of the lamp bulb.

In any event, amended claim 29 now recites that the oxide is configured to preserve a profile of the microstructure in case of <u>melting</u> of the respective material, consequent to the use of the emitter body at an operating temperature exceeding the melting temperature of the material. This feature is neither disclosed nor suggested by Richard or Levinson, whose filaments are made from tungsten (or carbon) and operated at a temperature <u>lower</u> than the melting point of tungsten (or carbon).

All the rejections of the other claims, i.e., claims 30-41, 43-46, 48-50 and 53-54, based on the combination of Levinson, McMaster and Richard, are also traversed for the same reasons noted above.

Applicant further notes that the rejection of claim 34 is also the result of hindsight

reasoning. Claim 34 states that the emitter body is formed of two materials, having melting temperatures higher and lower, respectively, than the operating temperature of the emitter body.

In Levinson the emitter is made of tungsten, which has a melting temperature above the operating temperature of the emitter. Levinson specifically teaches forming the microstructure with a refractory oxide (embodiment of figures 1-3) or tungsten (embodiment of figure 4), i.e., materials whose melting points are above the operating temperature of the emitter. The general teaching of this references is ***opposite*** to claim 34, i.e., it teaches away from the claimed invention. Similarly, Richard discloses a filament of tungsten coated with a refractory oxide, i.e., two materials having respective melting points above the operating temperature of the emitter. As mentioned above, McMaster does not disclose a light emitter. Additionally, in McMaster cathode 13 is made by a copper plate which is plated with silver, i.e., two materials having a low melting point compared to tungsten, which is, again, a teaching away from claim 34. Furthermore, no microstructure is provided in McMaster.

The rejection of claim 35 is also unsound. Claim 35 states that the microstructure, i.e., the outer surface of the emitter body, is made of material selected from among gold, silver and copper. The only reference citing a microstructure is Levinson. However, as noted above, Levinson specifically teaches that the microstructure has to be formed with a material having a melting temperature higher than the operating temperature of the emitter, i.e., a refractory oxide (figures 1-3) or tungsten (figure 4). This is completely different than the claimed invention.

Additionally, it is noted that McMaster teaches arranging a conducting base of gold or silver underneath the "active" material of the phototube, i.e., underneath the photo-electric surface of the photocathode 13 (photocathode 13 of McMaster, which is made of copper, is coated with the conductive layer of gold or silver, which is in turn coated with the "active"

material, i.e., the photo-electric material). Thus, even in the case of an improper combination of Levinson with McMaster, the conductive layer suggested by McMaster would be arranged underneath the "active" nanostructure of Levinson.

With respect to claim 39, it states that the grating, i.e., the microstructure, is obtained through

- a first conductor material melting at higher temperature than the operating temperature of the emitter,

- a coating layer which covers at least the structured part of the first material, the coating layer being of a second material selected among conductor, semiconductor or composite materials melting at lower temperature than the operating temperature of the emitter,

where the coating layer copies the profile of the structured part of the first material and the second material has a greater emission efficiency than the first material.

Again, Levinson teaches that the micro-structure has to be made of a material having a melting temperature greater than the operating temperature of the emitter. On the other hand, neither McMaster nor Richard teaches coating a microstructure with a material having a low melting point and having improved emission efficiency. Richard teaches coating the whole emitter with a refractory oxide. McMaster teaches providing a conductive material, be it gold or silver, underneath an active part, i.e., the photoelectric material. Thus, there is no teaching to coat a microstructure with a low melting point material, as required in the claimed invention.

Similar considerations apply to claims 40 and 41.

The rejection of claim 53 is again, the result of improper and incorrect hindsight. According to claim 53, the body of the emitter is made of a material having a melting temperature lower than the operating temperature at which the emitter is meant to be used.

Levinson and Richard teach forming the emitter with tungsten, which has a melting temperature higher than the operating temperature of the emitter. This is in clear contrast to claim 53. And, as noted above, McMaster does no relate to incandescence emitters.

Claim 42 stands rejected as allegedly being obvious based on Levinson, McMaster, Richard and in further view of Chappell. Applicant traverses this rejection for at least the reasons noted above and the following reasons.

This rejection attempts to improperly combine four documents, two of which - i.e., McMaster and Chappell - do not relate to incandescence light emitters. Respectfully stated, the Examiner starts from the incorrect combination of Levinson, McMaster, Richard and then states that, "*in the same field of endeavour*," and "*towards solving the same problem of expansion of electrodes due to high temperatures*," Chappell teaches an electrode with a throat or cavity in order to lessen the degree of thermal stress. Applicant strongly disagrees with these assertions.

First, respectfully stated, the alleged "*same field of endeavour*" is in the Examiner's mind only. Chappell relates to an electrode for ***furnaces***, and more specifically to ***large*** electrodes (some inches). According to claim 29, how can electrodes of several inches be arranged within a common lamp bulb? Indeed, one skilled in the art of incandescence light emitters structured to micrometric dimensions would not seek inspiration in the field of large electrodes for furnaces.

Second, contrary to the Examiner's allegation, the subject matter of claim 42 has nothing to share with "*expansion of electrodes due to high temperatures.*"

According to original claim 42 (see also paragraph 70 of the Application as published), at least a throat or cavity is provided, open on the material constituting the emitter and defined in at least one of the electrodes and the refractory oxide, the cavity or cavities being operative to receive part of the material of the emitter body as a result of volume expansions thereof. More

specifically, if the emitter material melts, a part thereof can be received within the throat or cavity of the electrodes or the oxide layer. The cited art does not disclose or suggest these claim features.

Chappell explains that carbon electrodes used in furnaces are subject to high deformations. To avoid this problem, Chappell suggests providing the large electrodes with through slots, to obtain "controlled" deformations of the electrodes and avoid breaking thereof. This has nothing to share with the subject matter of claim 42, wherein the throats or cavities are provided for receiving the low melting point material of the emitter.

If electrodes as in Chappell were applied to a filament according to the claimed invention, the melted material would "escape" from the electrodes because the slots of Chappell are configured as through slots. Additionally, Chappell explains (column 3, lines 47-61) that in the preferred embodiment the slots of the electrodes are filled with a soft inert material to avoid entry of air or oxidant gases. If the slots of Chappell are filled with a material, they are not sufficiently able to receive part of the material of the emitter, following the change of state thereof.

In any event, claim 42 has been amended to recited that the throat or cavity is defined in the oxide material, which feature is neither disclosed nor suggested by the prior art.

Claim 47 stands rejected as allegedly being obvious over Levinson in view of McMaster and Richard and further in view of Gee. Applicant traverses this rejection as stated above because claim 47 depends from claim 29, which is patentable over any "reasonably apparent" combination of the references.

With respect to claims 51 and 52 that stand rejected based on Levinson, McMaster, Richard and in further view of Fujishima, the Examiner combines four documents, two of which

- i.e., McMaster and Fujishima, do not relate to incandescence light emitters.

The rejection of claim 51 is improper hindsight. The rejection states that Levinson teaches forming a microstructure by etching, and then states that, "*in the same field of endeavour,*" Fujishima teaches the part of claim 42 lacking in the combination of Levinson, McMaster and Richard. The rejection concludes that it would have been obvious for one skilled in the art "*to modify the method as disclosed by Fujishima for the device of the previous combination in order to achieve minimized (microstructure) size of the electron emission source.*" Applicant strongly disagrees with these assertions and the alleged combination.

First, Fujishima does not relate to incandescence emitters and does not provide for any antireflection microstructure. Fujishima relates to a process for manufacturing an electron emission source (see for instance paragraphs 4 and 46), i.e., an electrode and, more precisely, a field emission cathode. An electrode of this kind neither emits light, nor is brought to incandesce. Light emission is never mentioned in this document. Fujishima describes a method for forming an electron emission electrode that includes a diamond cylinder array, each diamond cylinder having a dent in the respective top portion (see fig. 6). The method provides for the use of porous alumina, in the pores of which diamond nano-particles are first inserted (fig. 2). In a subsequent step, a composite body is obtained, by conducting the vapour phase growth of diamond, which body reproduces the shape of alumina (fig. 3). The film of alumina is then dissolved (fig. 4). Finally, a dent is formed on the head of each diamond cylinder, through plasma etching (fig. 6). Provision of the dents is the specific object of the invention of Fujishima, with the aim of improving electron field emission.

The technical field of Fujishima is completely different than the field of the claimed invention relating to emitters or filaments which must be brought to incandescence to emit light.

The device of Fujishima is an electron emission source for use in a display, a gas sensor or an electrode. The diamond structure of Fujishima cannot be used as an incandescence light source because it is unable to emit incandescence through the passage of current. Diamond with boron as a dopant has, at the very most, an electroluminescent behaviour, which can be used in back-light liquid crystal displays. Electroluminescence is an optical and electrical phenomenon where a material emits light in response to an electric current or to a strong electric field: this is distinct to light emission resulting from heat, i.e., incandescence.

Furthermore, the microstructure of Levinson obtained by etching has micrometric dimensions. In column 3, lines 43-57, Levinson teaches a diameter of the cavities between 0.2 to 2 microns, which means 200 to 2000 nm. On the other hand, Fujishima mentions (paragraph 24) pore diameters of 5 to 400 nm.

It is not "reasonably apparent" (per the Supreme Court) why a skilled person would have to "*modify*" the method as disclosed in Fujishima, provided that it already allows for obtaining a size of the structure of the electron emission source which is "*minimized*" with respect to the one indicated by Levinson. Moreover, there would be no reason to "*minimize*" the size of the microstructure of Levinson according to Fujishima. Indeed, the size indicated by Levinson is functional to the desired effect of improving radiative efficiency. If one changed the size of the microstructure of Levinson (i.e., a diameter of the cavity lower than 200 nm), then the desired effect of improving radiative efficiency could not be obtained. This is a clear indication of improper hindsight because the combination/modifications of the prior art stated in the rejection run counter to the express teachings and goals of the prior art.

The rejection of claim 52 is even more improper. The rejection alleges that claim 52 is obvious in view of Levinson, McMaster, Richard, Fujishima and a generic "routine skill."

The rejection states that Fujishima would disclose a first phase of anodisation and a phase of reducing the irregular alumina film obtained as a result of the first anodisation. However, this is not true. Fujishima implicitly provides for a step of anodisation. No mention is given in Fujishima concerning a reduction phase.

The rejection also incorrectly states that it would have been obvious to a person having ordinary skill in the art to provide a second phase of anodisation of the alumina film starting from the residual part of irregular alumina not eliminated by the reduction phase (which is lacking in Fujishima) since "*mere duplication of the essential working parts of a device involves only routine skill in the art.*" Respectfully stated, we are unable to understand the reasons given by the Examiner. Claim 52 relates to a method claim concerning the way in which an alumina film is obtained through a series of successive steps (i.e., first anodisation, reduction, second anodisation, etc.), for the reasons explained in paragraphs 73 to 79 of the application as published.

In summary, for at least the foregoing reasons, the rejections fail to state a prima facie case of obviousness because there is no "reasonably apparent" way to combine the cited references and arrive at the claimed inventions. Indeed, the rejections contain factually incorrect and hindsight combinations of the references, e.g., incorrect combination of Levinson, McMaster and Richard, improper hindsight and incorrect usage of McMaster, and incorrect assertions that the cited references "implicitly" disclose certain features while the same references "explicitly" contain opposite teachings. Finally, the rejections incorrectly extrapolate parts of the disclosures of the references which are functional to the rejections without properly considering the overall teachings of the references at issue and the scope of the claims.

Applicant submits that the subject application is in condition for allowance and earnestly

solicits a notice to that effect.

If the Examiner has any questions concerning this application, the undersigned may be contacted at 703-816-4009.

Respectfully submitted,

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